

AXIALLY ACTUATED VALVE FOR DISPENSING  
PRESSURIZED PRODUCT

Background Of The Invention

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This invention relates to an improved valve to be used for a pressurized container and more particularly to one that is adapted to be used in a pressurized dispensing container for a viscous product or fibrous product or particle containing product.

10 Hand held pressurized dispensing containers having a tilt action valve assembly have been known for a long time. Applicant's Patents No. 5,785,301 and No. 6,425,503 are representative of prior art valve designs for use in these pressurized dispensing containers. When the valve is tilted, at least one full opening is exposed to the contents of the container. The contents, under pressure from a piston or a bag in a pressurized container, will be dispensed through the 15 openings in the valve stem.

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It has been found that when discharging viscous product or fibrous product or the like, the flow of material is either slow or stops.

25 One solution provided by Patent No. 6,425,503 was to employ a tilt valve having two fairly large openings in which only one of the two openings is exposed to the material to be dispensed when the valve is tilted.

However, there are applications in which such a design fails to provide a satisfactory flow rate. Such applications include the dispensing of highly viscous products such as certain silicones, fiber containing 5 product such as tire sealant and lumpy product such as salsa.

Accordingly, it is a major purpose of this invention to provide a valve design for pressurized dispensing containers in which product of the above type can be 10 readily dispensed at a satisfactory flow rate.

Brief Description

In brief, a pressurized dispensing container valve disclosed herein has two and only two opposed openings in the valve stem. In dispensing product, the valve stem is moved in an axial direction down into the container so that both of the openings are in full communication with the material to be dispensed. The two dispensing openings are in radial registry. That is, the center of the two openings are  $180^{\circ}$  removed from each other. When product is to be dispensed, the flow through the two openings is of such a nature that it carries the material to be dispensed through the openings so that they do not build up at the sidewall near the openings and thus do not clog the openings. The openings have an arc or span that is substantially greater than the arc in the openings employed in prior art valves having multiple stem openings.

For example, instead of having four openings with a span of between  $50^{\circ}$  and  $60^{\circ}$ , as is known in the art, the openings in the valve stem described herein are between  $90^{\circ}$  and  $130^{\circ}$ . The sum of the two valve stem openings is approximately equal to the cross-sectional area of the valve stem passageway to assure a continuous smooth flow.

In order to assure that the full span of both openings is in communication with the material being dispensed, the valve is actuated in an up-down direction.

The larger valve openings, particularly where each spans 130°, leaves a much reduced wall span between openings. To assure wall strength, the wall between opening is reinforced by being thickened.

5 Since the actuation is in an axial (up and down) direction, a minimum diameter valve stem seat or base is used to reduce the force needed to move the valve against the pressurized contents.

Brief Description Of The Figures

FIG 1 is an elevation view in partial longitudinal section of a valve assembly incorporating the valve 14 of 5 this invention mounted on a pressurized container 12.

The valve has dual openings 24 in the valve stem and is enabled for movement in an axial direction. FIG. 1 shows the valve in the axially up, normal sealing state.

FIG. 2 is a view similar to that of FIG. 1 except 10 that the valve is axially depressed into its dispensing state.

FIG. 3 is a longitudinal view in partial elevation and partial section showing the relationship of the valve 14 to the flexible boot or seal 16. FIG. 3 shows the 15 mounting of the boot 16 to the top 36 of the pressurized container. The nozzle actuator 18, shown in FIGs. 1 and 2, is not shown in FIG. 3. FIG. 3 is a view 90° rotated from FIGs. 1 and 2. Thus FIG. 3 shows the opening 24 straight on.

20 FIG. 4 is a simplified cross-sectional view along the plane 4-4 of FIG. 5 showing the two valve stem sidewall openings 24 and the associated thickened sidewall segments 38 between the openings.

25 FIG. 5 is a vertical section view of the lower portion of the valve 14 showing the thickened sidewall segments 38.

FIG. 6 is a simplified longitudinal-sectional view of the boot or sealing element 16 that is used in the valve assembly.

FIG. 7 is a simplified longitudinal-sectional view 5 of the nozzle-actuator 18 that fits around the valve 14.

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Description Of The Preferred Embodiments

All the FIGs. show a single embodiment. FIGs. 1 and 2 show a valve assembly 10 mounted on a container 12. 5 The product in the container 12 is maintained under pressure, typically by a pressurized piston or pressurized bag (not shown). When the valve assembly 10 is depressed, material is dispensed from the container through the valve assembly 10.

10 The valve assembly 10 includes three primary separate components. They are: a substantially annular valve 14, an annular flexible boot or sealing element 16 and a substantially annular nozzle-actuator 18.

15 As can best be seen in FIG. 3, the valve 14 has a stem 20, a seat 22, and two stem sidewall openings 24. A longitudinal passageway 26 in the stem 20 is in communication with the sidewall openings 24 so that material in the container under pressure will be dispensed through the sidewall openings 24 and the 20 passageway 26 into the nozzle 18.

The resilient boot 16 holds the valve 14 and nozzle 18 in the FIG. 1 position, which is a non-dispensing position. In the FIG. 1 position, the valve stem openings 24 are not in communication with the interior of 25 the container 12 because the seal 16 blocks the openings 24.

As shown in FIG. 3, the boot 16 engages the upper surface 36 of the container 12 in the fashion shown in FIG. 3. FIG. 3 shows the non-dispensing state in which the two valve stem openings 24 are within the boot 16 sealed from the contents of the container. When the valve 14 is depressed through actuation of the nozzle-actuator 18, the thin segment 34 of the boot 16 flexes permitting the valve to move down into the container sufficiently so that, as shown in FIG. 2, the entire area of both openings 24 are in communication with the material to be dispensed from within the container 12.

It is preferred to keep the diameter of the valve seat 22 as small as possible to minimize the force required to move the valve against the pressure of the contents within the container. In one embodiment, the valve seat 22 has a diameter of 370 mils (0.370 inches).

As shown in FIGS. 4 and 5, the two valve stem openings 24 between them, span a majority of the circumference of the valve stem at the zone of the openings.

In one embodiment, these openings 24 are each 130°. Each sidewall segment 38 encompasses only about 50° of arc. In order to assure that the wall segments 38 have the strength to withstand the pressure and forces on the stem wall, the segments 38 are made thicker than the rest of the stem wall.

In one embodiment, in which the stem wall has a thickness of about 30 mils (0.030) inches, the wall segments 38 are built radially outward to have a thickness of about 60 mils (0.060) inches.

5 FIG. 6 is a cross-sectional view through the boot 16 showing the thinner segment 34 which facilitates compression of the boot 16 when the valve 14 is moved from its non-dispensing state to its dispensing state. As may be seen in FIG. 6, the base of the boot 40 has a 10 small step 42. This provides a small annular sealing segment for initial contact against the valve seat 22 and assures a relatively high pressure at the segment 42 so that this annular segment 42 will readily compress and assure sealing.

15 In one embodiment, the sealing segment 42 is an annulus having an inner diameter of 295 mils and an outer diameter of 355 mils and thus a wall thickness of 30 mils. The segment 42 is only seven mils tall; that is, the step 40 is seven mils. This is found to improve 20 sealing.

A small retaining wall 49 (see FIG. 3) between the bottom edge of each opening 24 and the valve seat 22 serves to assure that the flexible sealing element 16 does not extrude into the opening 24 when under the 25 internal container pressure during the non-dispensing sealing state. In one embodiment, the retaining wall 49 is 40 mils tall.

The nozzle-actuator 18, shown in FIG. 7 has an annular flange 30 which limits the downward movement of the actuator 18 and thus of the valve 14 (see FIG. 2). The annular leg 31 of the actuator 18 engages the 5 container top 32 in such a fashion as to prevent tilting the valve.

The valve of this invention; specifically a valve that has an up-down movement and has no more than two relatively large stem openings 24, provides an ability to 10 obtain a higher flow rate of viscous products and further provides that higher flow rate while giving the user the ability to control the flow rate. The valve design of this invention is useful for highly viscous products such as heavy roofing cement and gasket sealant and also with 15 medium viscous products such as silicone and caulk.

By simultaneously exposing two large valve stem openings 24 to the material to be dispensed, a higher flow rate is obtained than can be obtained with any tilt valve type of design.

20 Furthermore, by having two and only two valve stem openings, the result is to have two and only two legs 38 between the openings. As a consequence, as shown in FIG. 4, the legs 38 can be made sturdier than would be the case with more than two valve stem openings and thus more 25 than two legs between openings. The sturdy legs 38 have the advantage of being able to stand up under the

pressures that are necessary when dispensing viscous materials.

There is tendency on the part of individuals who are used to tilt valves to sometimes try to force the up-down 5 valve into a tilt position. This strains the legs and the sturdiness of the dual leg design minimizes the risk that the valve will break under such inappropriate tilt.

Use and control over the flow rate is provided by the fact that the extent to which the user depresses the 10 valve will affect the amount of the valve opening and thus the flow rate.

When viscous material contains fibers, such as is the case with tire sealant, the dispensing problem is compounded by the fact that the fibers can build up by 15 wrapping around the thin legs between valve openings that exist with more than two openings. This build up tends to clog the opening. The design of this invention works well with viscous products having fibers in part because of the even high flow rates that are made available and 20 in part because the legs are thicker.

It is known in this art, and Applicant has observed such, that the fibers of fibrous product tend to clog the valve openings. In large part, this clogging appears to occur when the fibers are caught by and wrap around the 25 wall segments or legs between openings.

Applicant has tested devices having the design of this invention and found that clogging that would otherwise occur does not occur.

Applicant hypothesizes that it is primarily because 5 of the geometry of the flow caused by having two openings 24 in radial registry with one another. The flow pattern tends to carry the fibers with the rest of the material being dispensed toward and through the two openings in a fashion that substantially avoids the wall segments 10 between the openings. The flow with two openings is circumferentially even and balanced.

By contrast, when the typical axially movable valve has four openings, the flow toward adjacent openings tends to be partially intercepted by the wall segments or 15 legs between the adjacent openings so that fiber wraps around and/or otherwise adheres to the legs causing a build-up that ultimately blocks a larger part or even all of the opening. Applicant is not sure that this is the explanation but believes, because of his experience, that 20 this is a likely explanation. Indeed, Applicant has observed that four hole designs always fail.

To maintain the even flow through the openings 24, which appears to minimize clogging, it is preferred that the cross-sectional area of the flow path into which the 25 openings 24 communicate be nearly equal to or greater than the sum of the cross-sections of the two openings

24. In one embodiment, each valve stem opening 24 is 166

mils wide by 82 mils tall and the diameter of the passageway 26 immediately above the openings 24 is 184 mils. Thus the two valve openings 24 provide a portal of 0.02765 in<sup>2</sup> into a 0.026 in<sup>2</sup> passageway 26. Smooth flow 5 is maintained by avoiding step-like breaks in the flow path of material through the valve stem on nozzle.

In the embodiment shown, which is adapted to be used for dispensing a fiber containing tire sealant product, the end 28 of the nozzle-actuator 18 (see FIG. 7) is 10 configured to fit the valve of a tire. In operation, the user holds the container 12, fits the nozzle tip 28 into the tire valve stem and presses the container assembly against the tire valve. This forces the nozzle-actuator 18 down against the container by an amount that is 15 determined by engagement between flange 30 and container top at 32. This causes the segment 34 of the boot 16 to bow outwardly and permit the valve to be depressed from its sealing state of FIG. 1 to its dispensing state of FIG. 2.

20 Products other than tire sealant also flow better (that is, faster and more evenly) when the valve of this invention is employed. Highly viscous product, over 200,000 cps (centipoise) such as caulk and RTV silicone flow better through the valve. This valve would have 25 useful application to dispensing a silicone gasket maker with approximately a two million centipoise parameter. It is believed that the valve would also improve flow

rates and flow consistency with materials having a clumpy parameter such as salsa or even cheese with jalapeno peppers.

While the foregoing description and drawings 5 represent the presently preferred embodiments of the invention, it should be understood that those skilled in the art will be able to make changes and modifications to those embodiments without departing from the teachings of the invention and the scope of the claims.